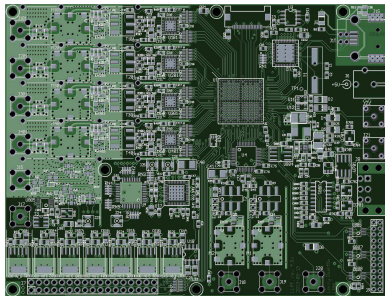


LLRF46 (2013)



Major revision of established LLRF4 board to upgrade FPGA to Spartan-6

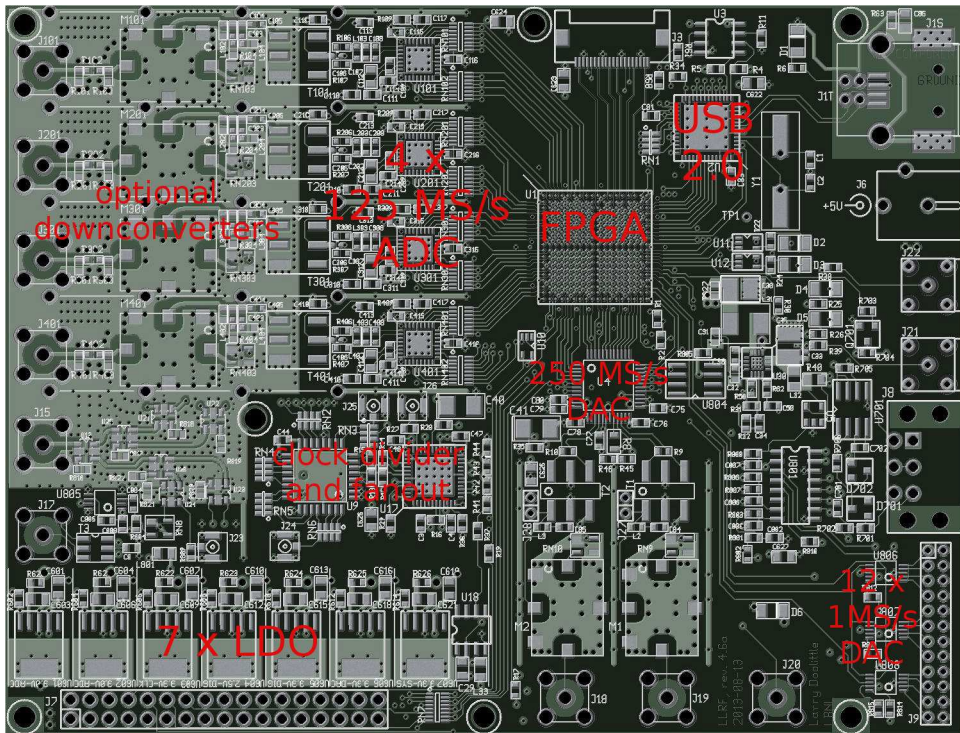
Joint project of this group and Dimtel

Public design files at <http://www.dimtel.com/support/llrf4/index>

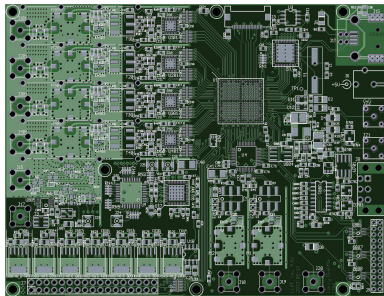
Semi-stock item at Dimtel

- Mixer and analog filter configuration selectable at build-time
- Ships fully tested and calibrated

127 mm \times 97 mm, 1 A at 5 V



LLRF46 (2013)



Relevance to LCLS-2:

- 4 input channels work fine at 20 MHz IF
- ADC and DAC consistent with 94 and 188 MS/s operation
- Optional up- and down-conversion on board

Interface is via USB, can be bridged to Ethernet by a general-purpose single-board computer (generally not considered real-time)

Missing:

- Timing and other high-speed fiber I/O
- Large local data storage
- Split-LO in on-board configuration
- Amplifier between mixer and ADC

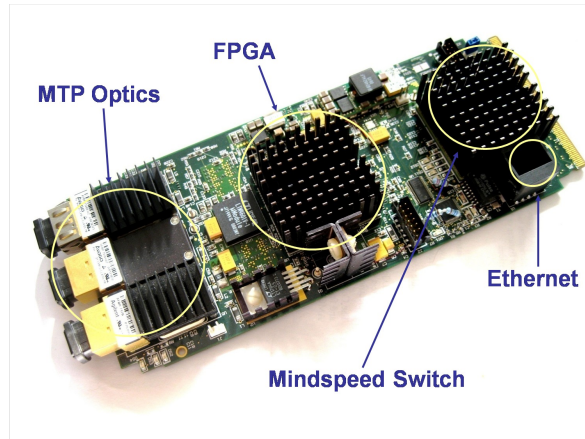
GCT Leaf
64Gb/s
Asymmetric

Matrix
96Gb/s
Symmetric

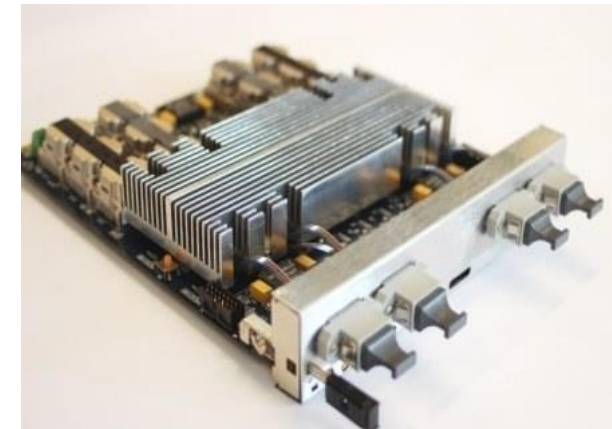
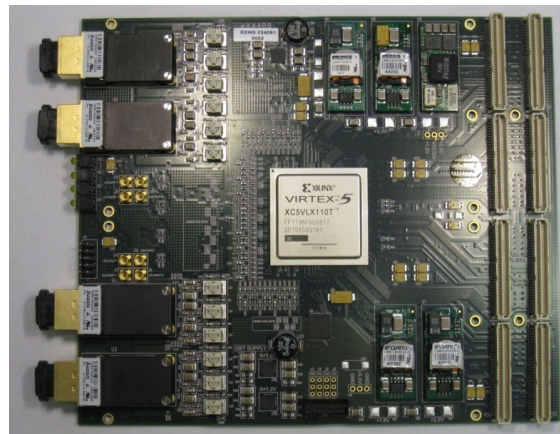
Opto-GTI
96Gb/s
Symmetric

Mini-T
330Gb/s
Asymmetric

MP7
1800Gb/s
Symmetric



Top



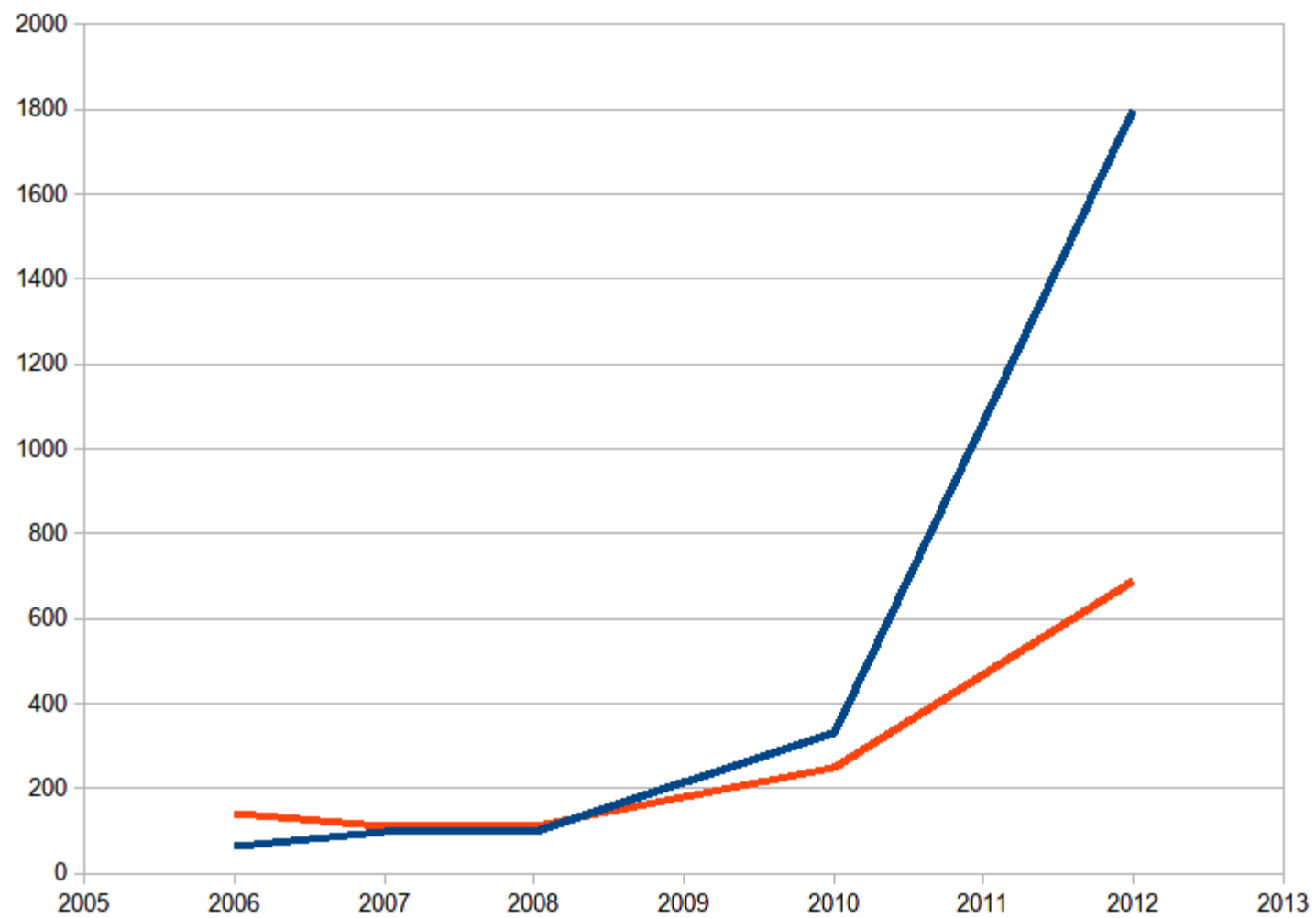
2006
V2 Pro

2007
Virtex 5

2008
Virtex 5

2010
Virtex 5 TXT

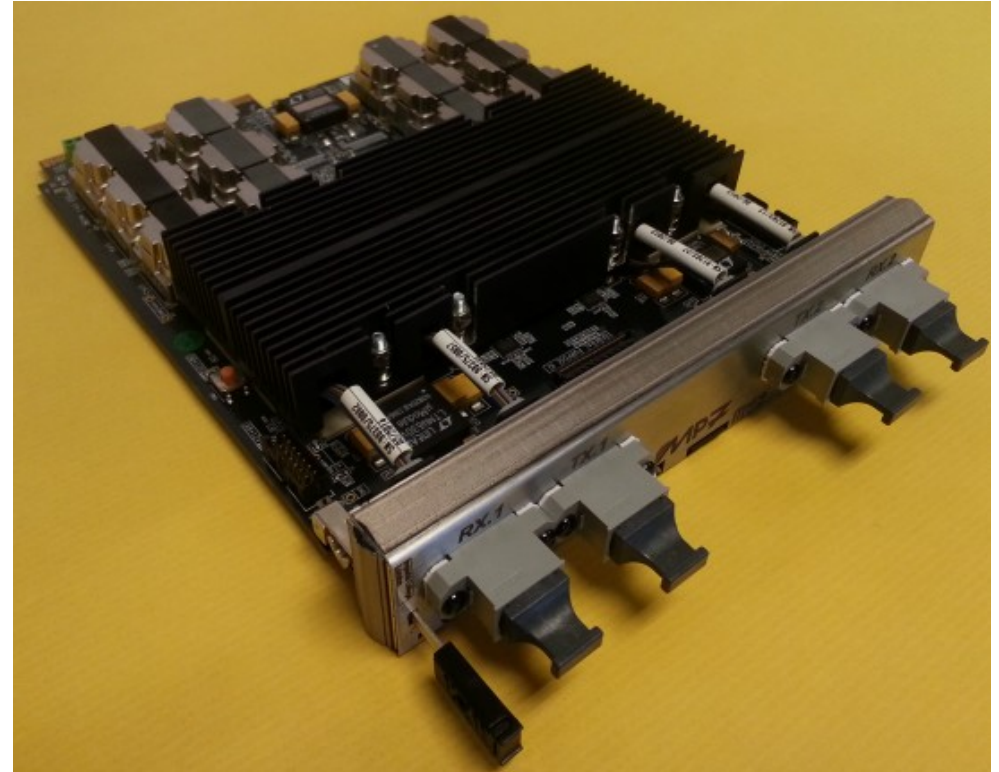
2012
Virtex 7



MP7 (2012-2014)

- uTCA form factor.
- 72 optical links @ 12.5Gb/s => ~1.8Tb/s signal processor.
- Xilinx Virtex 7-690
- 288Mb QDRII+ SRAM.
- GbE, PCIe, SAS, SATA.
- P/I/V/T & humidity monitoring.
- Advanced boot-loader.
- Flexible clock tree
(backplane + external)
- Full system test at startup.
- On-board firmware repository.

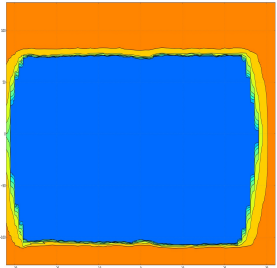
~\$15k / board



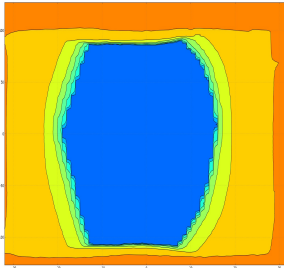
1Gb/s - 10Gb/s – 8b10b - 72 links

GTX (Virtex 7 485 Transceiver)

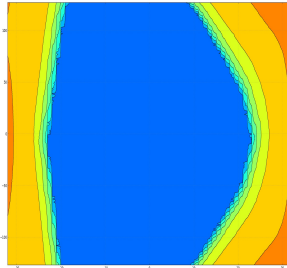
1Gb/s



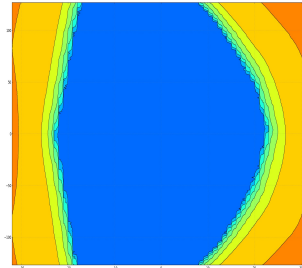
2Gb/s



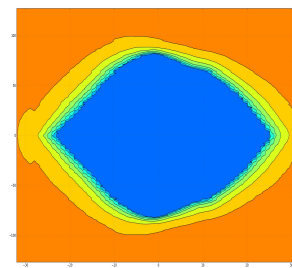
4Gb/s



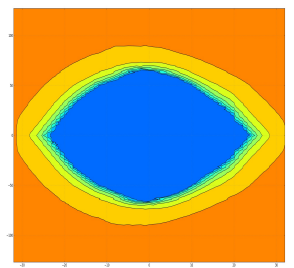
5Gb/s



8Gb/s

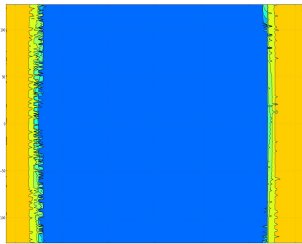


10Gb/s

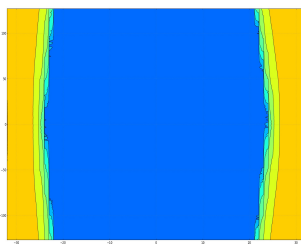


GTH (Virtex 7 690 Transceiver)

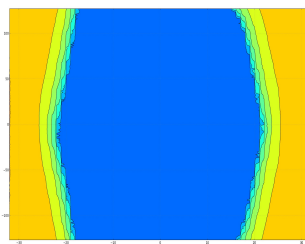
1Gb/s



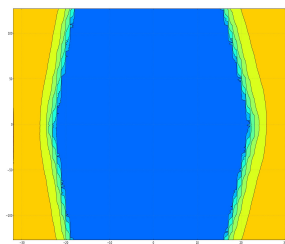
2Gb/s



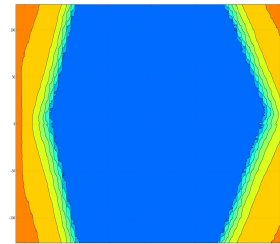
4Gb/s



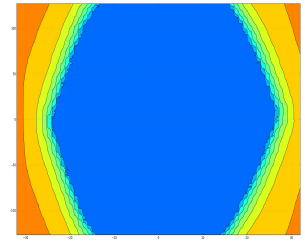
5Gb/s



8Gb/s



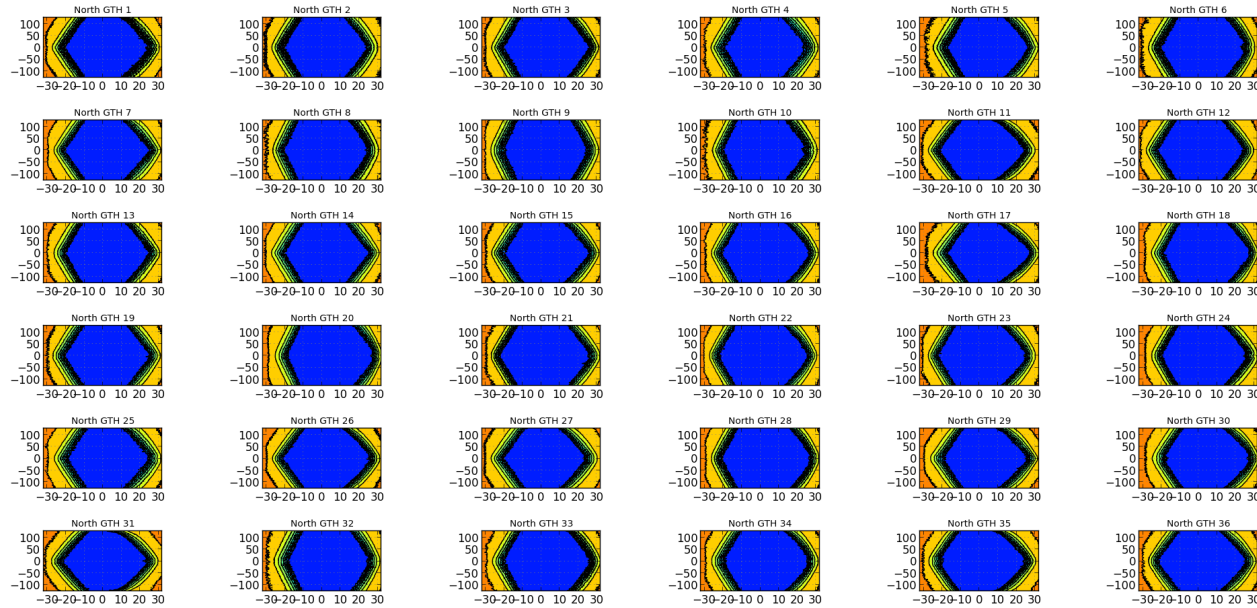
10Gb/s



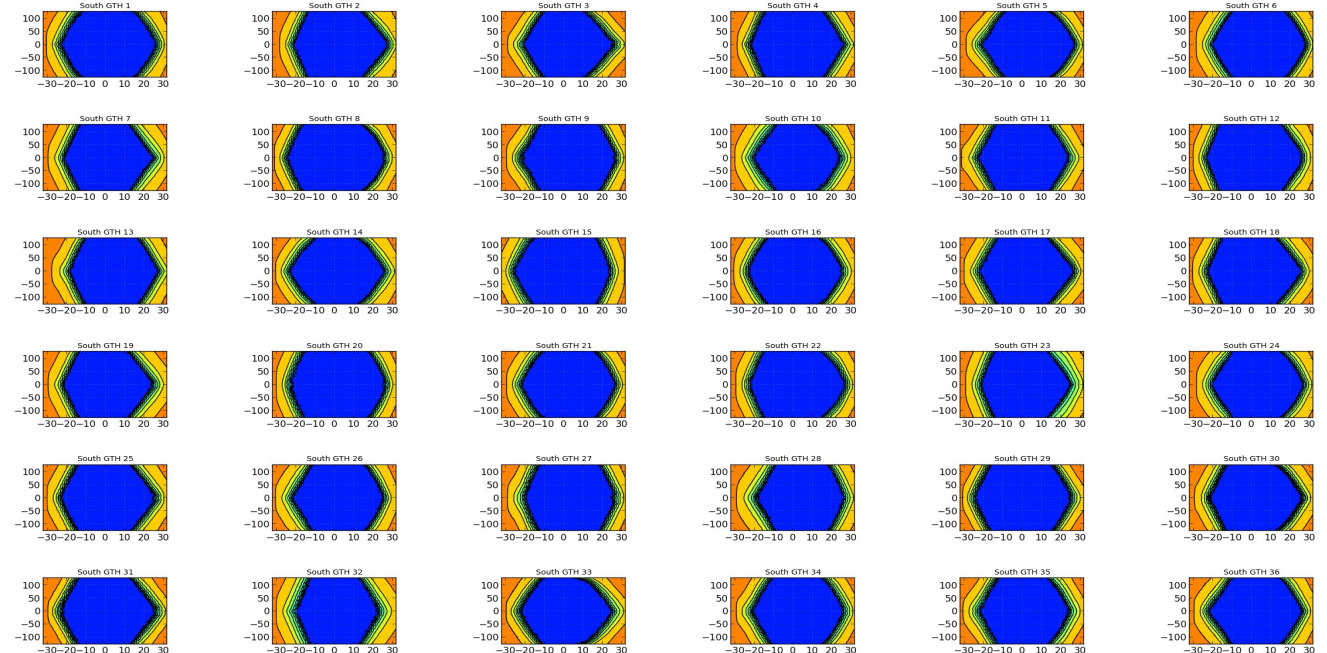
Using: Dynamic line rate control & buffer manipulation

Meets industrial standards

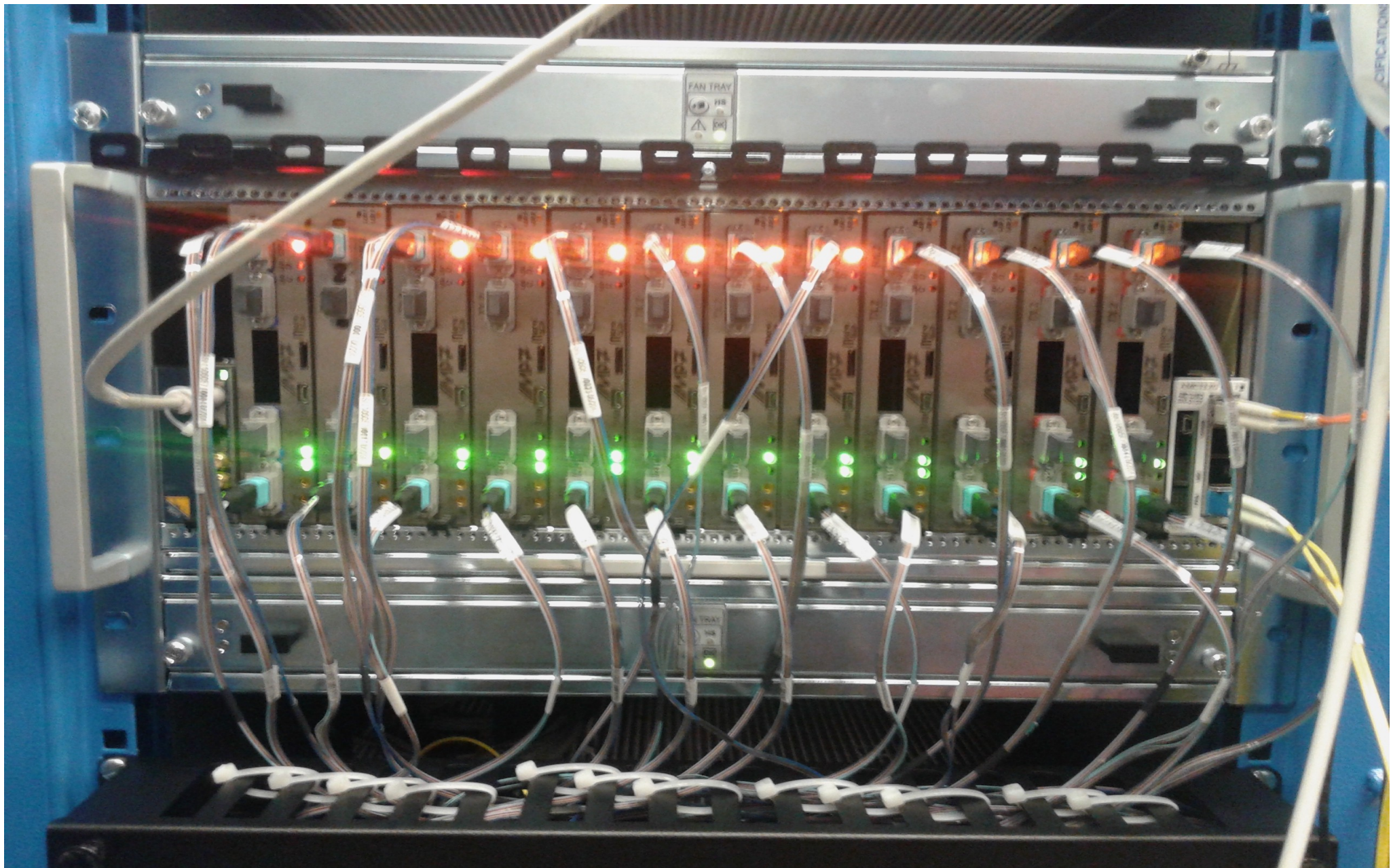
72 links, 10Gb/s - Eye Diagrams



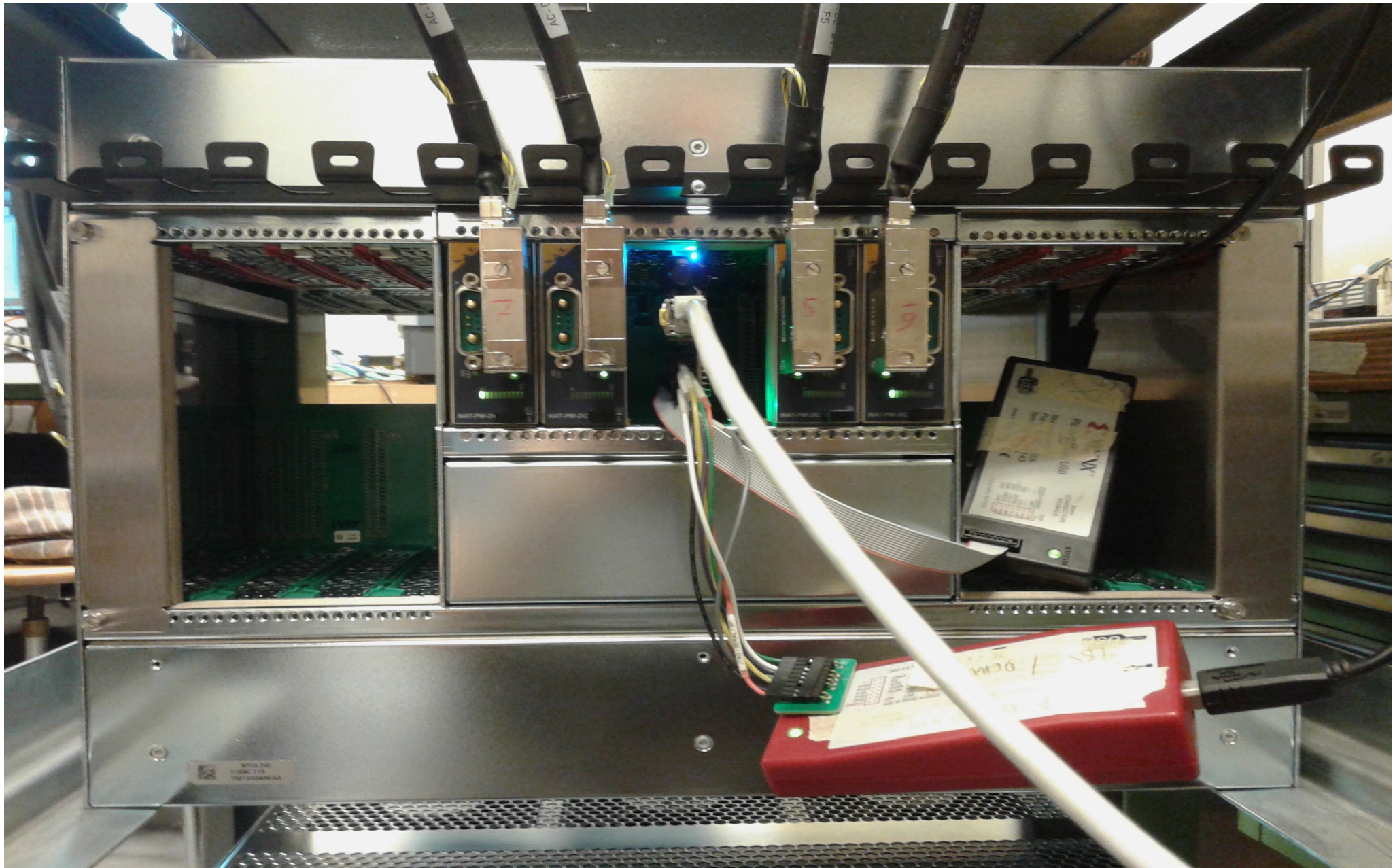
All running in parallel
PRBS-7 pattern



17.82Tb/s...



Back of Crate



BMB7 (2014-)

- uTCA scale industrial FMC carrier – designed for autonomous use.
- 8 optical links @ 10.3Gb/s.
- 4 optical links @ 3.2Gb/s.
- Xilinx Kintex-7 160T (Application).
- Spartan-6 45T (Boot).
- GbE, PCIe, SAS, SATA.
- TRNG / encryption / hash.
- P/I/V/T & humidity monitoring.
- Boot over Ethernet / PROM.
- Flexible clock tree.
- Single-board computer.
- Granular power supply.
- Wake on LAN.

~\$2k / board

